

WHAT IS CLAIMED IS:

1. A bone fixation device, comprising:
 - one or more plates, each comprising:
 - a bone-contacting surface;
 - an upper surface opposite the bone-contacting surface; and
 - one or more fastener-receiving apertures extending through the plate from the upper surface to the bone-contacting surface, wherein the fastener-receiving aperture comprises a frustoconical inner surface; and
 - one or more fasteners having a head that has an arcuate outer surface, wherein one or more screws are configured to be received within one or more fastener-receiving apertures.
2. The bone fixation device according to claim 1, wherein the arcuate outer surface comprises a spherical outer surface.
3. The bone fixation device according to claim 1, wherein the fastener comprises a screw.
4. The bone fixation device according to claim 1, wherein the arcuate outer surface contacts the frustoconical inner surface of the fastener-receiving aperture during fixation of a bone with the device.
5. The bone fixation device according to claim 4, wherein a ring around the arcuate outer surface of the screw head contacts the frustoconical inner surface of the fastener-receiving aperture during fixation of a bone with the device.
6. The bone fixation device according to claim 1, wherein at least one fastener-receiving aperture comprises a frustoconical inner surface having a major opening proximate the upper surface of the plate and a minor opening proximate the bone-contacting surface.

7. The bone fixation device according to claim 1, wherein at least one fastener-receiving aperture comprises a major opening proximate the upper surface and a minor opening proximate the bone-contacting surface, wherein the major opening includes the frustoconical inner surface.

8. The bone fixation device according to claim 7, wherein the minor opening has a cylindrical inner surface.

9. The bone fixation device according to claim 3, wherein at least one screw comprises: a head having an arcuate outer surface with a diameter greater than a diameter of the minor opening; and an upper shaft having a diameter that matches the diameter of the minor opening.

10. The bone fixation device according to claim 9, wherein the upper shaft of the screw comprises: a major component proximate the head of the screw, wherein the major component has a diameter that matches the diameter of the minor opening; and a minor component proximate the lower shaft, wherein the minor component has a diameter that is less than the diameter of the minor opening.

11. The bone fixation device according to claim 3, wherein at least one screw comprises: a screw head having an arcuate outer surface and a diameter that is greater than a diameter of the minor opening; and an upper shaft having a diameter that is less than the diameter of the minor opening.

12. The bone fixation device according to claim 1, further comprising at least one locking arrangement configured secure at least one screw within at least one fastener-receiving aperture.

13. The bone fixation device according to claim 1, further comprising a plurality of locking arrangements configured secure at least one screw within one or more fastener-receiving apertures.

14. The bone fixation device according to claim 1, wherein the plate is an anterior cervical plate.

15. The bone fixation device according to claim 1, wherein the plate comprises a plurality of connectable plates.

16. The bone fixation device according to claim 12, wherein the locking arrangement comprises:

- a locking element; and
- a locking aperture.

17. The bone fixation device according to claim 16, wherein the locking element is rotatable within the locking aperture.

18. The bone fixation device according to claim 16, wherein the locking element comprises a locking cover and a shaft.

19. The bone fixation device according to claim 16, wherein the locking element has an unlocked position that permits insertion of a screw into the fastener-receiving aperture and a locked position in which the locking cover at least partially obstructs the fastener-receiving aperture.

20. The bone fixation device according to claim 18, wherein the locking element comprises a removable screw having a threaded shaft, wherein the threads are configured to mate with a threaded interior of the locking aperture.

21. The bone fixation device according to claim 16, wherein the locking element comprises a cap having circumferential threads configured to mate with a threaded inner surface of the locking aperture.

22. The bone fixation device according to claim 1, wherein the plate is concave along a longitudinal axis and a transverse axis.

23. The bone fixation device according to claim 16, wherein:

~~L II~~ ~~II~~ the locking aperture comprises an inner surface having at least one groove; and the locking element comprises:

a locking cover configured to secure the screw within the fastener-receiving aperture; and

a shaft comprising at least one projection configured to be received within the at least one groove.

~~L II~~ ~~II~~ 24. The bone fixation device according to claim 23, wherein the locking arrangement has a locked and an unlocked position.

~~L II~~ ~~II~~ 25. The bone fixation device according to claim 23, wherein one or more projections are configured to be received within one or more grooves when the locking element is in a locked position.

~~L II~~ ~~II~~ 26. The bone fixation device according to claim 23, wherein the shaft of the locking element comprises a plurality of projections.

~~L II~~ ~~II~~ 27. The bone fixation device according to claim 26, wherein the locking aperture comprises a plurality of grooves.

~~L II~~ ~~II~~ 28. The bone fixation device according to claim 23, wherein the locking aperture comprises one or more horizontal grooves.

~~L II~~ ~~II~~ 29. The bone fixation device according to claim 23, wherein the locking element further comprises one or more anchors configured to secure the locking element within the locking aperture.

30. The bone fixation device according to claim 29, wherein the anchor comprises a flange that extends radially outward from shaft of the locking element.

31. The bone fixation device according to claim 23, wherein the at least one projection is compressed radially inwards when the locking element is in an unlocked position and expands radially outward in one or more grooves when in a locked position.

32. The bone fixation device according to claim 1, further comprising at least one locking arrangement rotatably mounted to the one or more plates, the locking arrangement comprising:

- at least one locking aperture within the upper surface of the plate, the locking aperture having an inner surface; and
- at least one locking element, comprising:
 - a locking cover configured to secure the one or more screws in the one or more fastener-receiving apertures; and
 - a shaft rotatably mounted within the bore ;
 - a deformable member disposed between the shaft of the locking element and the inner surface of the locking aperture.

33. The bone fixation device according to claim 32, wherein the deformable member comprises a deformable cylinder

34. The bone fixation device according to claim 32, wherein the deformable member is constructed from ultra high molecular weight polyethylene (UHMWPE).

35. The bone fixation device according to claim 23, wherein the locking arrangement comprises:

- at least one locking aperture within the upper surface of the plate, the locking aperture having a threaded inner surface; and
- at least one locking element, comprising:
 - a locking cover configured to contact the upper surface of the plate; and

- a threaded shaft rotatably mounted within the bore, wherein the threads of the base are configured to mate with the threads of the bore such that the base has a predetermined initial and final position;
- a deformable member disposed between the base of the locking element and the inner surface of the bore.

36. The bone fixation device according to claim 35, wherein the locking arrangement has predetermined locked and unlocked positions.

37. A bone fixation device, comprising:

- one or more plates, each comprising:
 - a bone-contacting surface;
 - an upper surface opposite the bone-contacting surface; and
 - one or more fastener-receiving apertures extending through the plate from the upper surface to the bone-contacting surface, wherein at least one fastener-receiving aperture comprises:
 - a major opening proximate the upper surface, wherein the major opening comprises a frustoconical inner surface; and
 - a minor opening proximate the bone-contacting surface; and
- one or more screws having a head that has an arcuate outer surface, wherein the arcuate outer surface of the screw head is positioned adjacent the frustoconical inner surface of the fastener-receiving aperture during fixation of a bone with the device.

38. The bone fixation device according to claim 37, wherein the minor opening comprises a cylindrical inner surface.

39. A bone fixation device, comprising:

- one or more plates, each comprising:
 - a bone-contacting surface;
 - an upper surface opposite the bone-contacting surface; and

- one or more fastener-receiving apertures extending through the plate from the upper surface to the bone-contacting surface, wherein at least one fastener-receiving aperture comprises:

- a major opening proximate the upper surface, wherein the major opening comprises a frustoconical inner surface; and

- a minor opening proximate the bone-contacting surface, wherein the minor opening comprises a cylindrical inner surface; and

- one or more screws including a head having an arcuate outer surface with a diameter greater than a diameter of the minor opening, wherein the arcuate outer surface of the screw head is positioned adjacent the frustoconical inner surface of the fastener-receiving aperture during fixation of a bone with the device, the further including an upper shaft having a diameter that matches the diameter of the minor opening.

40. A bone fixation device, comprising:

- one or more plates, each comprising:

- a bone-contacting surface;

- an upper surface opposite the bone-contacting surface; and

- one or more fastener-receiving apertures extending through the plate from the upper surface to the bone-contacting surface, wherein at least one fastener-receiving aperture comprises:

- a major opening proximate the upper surface, wherein the major opening comprises a frustoconical inner surface; and

- a minor opening proximate the bone-contacting surface, wherein the minor opening comprises a cylindrical inner surface; and

- one or more screws including a head having an arcuate outer surface with a diameter that is greater than a diameter of the minor opening, wherein the arcuate outer surface of the screw head is positioned adjacent the frustoconical inner surface of the fastener-receiving aperture during fixation of a bone with the device, an upper shaft having a diameter that is less than the diameter of the minor opening.

41. A kit comprising:

- one or more plates, each comprising:
 - a bone-contacting surface;
 - an upper surface opposite the bone-contacting surface; and
 - one or more fastener-receiving apertures extending through the plate from the upper surface to the bone-contacting surface, wherein the fastener-receiving aperture comprises a frustoconical inner surface; and
- one or more fasteners having a head that has an arcuate outer surface, wherein the fastener is configured to be received within the one or more fastener-receiving apertures; and
- one or more locking arrangements configured to secure one or more screws in one or more fastener-receiving apertures.

42. The kit according to claim 41, wherein the fastener comprises a screw.

43. A bone fixation device, comprising:

- one or more plates, each comprising:
 - a bone-contacting surface;
 - an upper surface opposite the bone-contacting surface; and
- a locking arrangement, comprising:
 - at least one locking aperture within the upper surface of the plate, the locking aperture having an inner surface comprising at least one groove; and
 - at least one locking element, comprising:
 - a locking cover configured to secure the screw within the fastener-receiving aperture; and
 - a base comprising at least one projection configured to be received within the at least one groove.

44. The bone fixation device according to claim 43, wherein one or more projections are configured to be received within one or more grooves when the locking element is in a locked position.

45. The bone fixation device according to claim 43, wherein the shaft of the locking element comprises a plurality of projections.

46. The bone fixation device according to claim 45, wherein the locking aperture comprises a plurality of grooves.

47. The bone fixation device according to claim 43, wherein the locking aperture further comprises a first countersink proximate the upper surface of the plate.

48. The bone fixation device according to claim 47, wherein the locking element includes a locking cover that is configured to be received within the first countersink.

49. The bone fixation device according to claim 47, wherein the locking aperture comprises a second countersink proximate the bone-contacting surface of the plate.

50. The bone fixation device according to claim 49, wherein the locking element comprises an anchor configured to be received within the second countersink.

51. The bone fixation device according to claim 43, wherein one or more projections are configured to be received within at least one groove wherein when the locking element is in the locked position.

52. The bone fixation device according to claim 43, wherein the at least one projection is compressed radially inwards when the locking element is in an unlocked position and expands radially outward in one or more grooves when in a locked position.

53. A bone fixation device, comprising:

- one or more plates, each comprising:
 - a bone-contacting surface;
 - an upper surface opposite the bone-contacting surface; and
- a locking arrangement, comprising:

- at least one locking aperture within the upper surface of the plate, the bore having an inner surface comprising at least one groove; and
- at least one rotatable locking element having a locked and unlocked position, the locking element comprising:
 - a locking cover configured to secure a screw within the fastener-receiving aperture when in the locked position;
 - a shaft having a tip comprising at least one projection configured to be received within the at least one groove; and
 - an anchor proximate the tip of the shaft, wherein the anchor is configured to be received within a recess of the groove when in the locked position.

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54. A bone fixation device, comprising:

- one or more plates, each comprising:
 - a bone-contacting surface; and
 - an upper surface opposite the bone-contacting surface; and
- at least one locking arrangement rotatably mounted to the one or more plates, comprising:
 - at least one locking aperture within the upper surface of the plate, the locking aperture having an inner surface; and
 - at least one locking element, comprising:
 - a locking cover configured to secure the one or more screws in the one or more fastener-receiving apertures;
 - a shaft rotatably mounted within the locking aperture; and
 - a deformable member disposed between the shaft of the locking element and the inner surface of the locking aperture.

55. The bone fixation device according to claim 54, wherein the locking arrangement has a locked and an unlocked position

56. The bone fixation device according to claim 54, wherein the locking aperture extends between the bone-contacting surface and the upper surface of the plate.

57. The bone fixation device according to claim 54, wherein the deformable member comprises a deformable cylinder

58. The bone fixation device according to claim 54, wherein the deformable member is mounted to the inner surface of the locking aperture.

59. The bone fixation device according to claim 54, wherein the deformable member is mounted to a shaft of the locking element.

60. The bone fixation device according to claim 54, wherein the deformable member is constructed from a biocompatible plastic material.

61. The bone fixation device according to claim 54, wherein the deformable member is constructed from ultra high molecular weight polyethylene (UHMWPE).

62. A bone fixation device, comprising:

- one or more plates, each comprising:
 - a bone-contacting surface; and
 - an upper surface opposite the bone-contacting surface; and
- at least one locking arrangement rotatably mounted to the one or more plates having a predetermined locked position, comprising:
 - at least one locking aperture within the upper surface of the plate, the locking aperture having a threaded inner surface; and
 - at least one locking element, comprising:
 - a locking cover configured to contact the upper surface of the plate; and
 - a threaded shaft rotatably mounted within the locking aperture, wherein the threads of the base are configured to mate with the threads of the locking aperture such that the locking element has a predetermined initial and final position;
 - a deformable member disposed between the shaft of the locking element and the inner surface of the locking aperture.

63. The bone fixation device according to claim 62, wherein the locking arrangement has a locked and an unlocked position

64. The bone fixation device according to claim 62, wherein the locking aperture extends between the bone-contacting surface and the upper surface of the plate.

65. The bone fixation device according to claim 62, wherein the deformable member comprises a deformable cylinder

66. The bone fixation device according to claim 62, wherein the deformable member is mounted to the inner surface of the locking aperture.

67. The bone fixation device according to claim 62, wherein the deformable member is mounted to a shaft of the locking element.

68. The bone fixation device according to claim 62, wherein the deformable member is constructed from a biocompatible plastic material.

69. The bone fixation device according to claim 62, wherein the deformable member is constructed from ultra high molecular weight polyethylene (UHMWPE).